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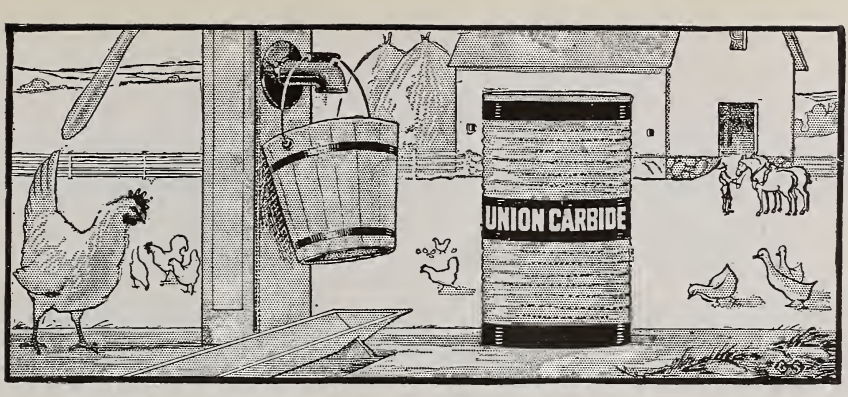

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... Contents ...

General View of Plots on the Ohio Agricultural Experiment Station

THE
AGRICULTURAL STUDENT

Vol. XXIV. OHIO STATE UNIVERSITY, COLUMBUS, NOVEMBER, 1917 *No. 3*

GROWTH OF AGRICULTURAL EXPERIMENTS IN OHIO

A Complete History of the Station Since Its Organization in 1882, Telling of the Early Experiences on the Farm and Why It Had To Be Removed From the University Campus

DIRECTOR CHARLES E. THORNE, Wooster, Ohio

FORTY years ago this summer there were harvested on the farm of the Ohio Agricultural and Mechanical College, on the spot now occupied by the engineering and aviation buildings two or three varieties of wheat which had not been grown previously in Ohio. The seed was sent to the college by the U. S. Department of Agriculture, and sown under the supervision of Dr. Norton S. Townshend, Professor of Agriculture, a chair which then included the subjects of crop production, soil fertility, animal husbandry, breeding, meat production, dairying, sheep and swine husbandry, poultry keeping, veterinary medicine, horticulture and botany, and the incumbent of which was expected to occupy his leisure time in the superintendence of the college farm.

These wheats were exhibited at the Ohio State Fair, then held on the grounds now occupied by Franklin Park, and attracted so much attention and encouragement that several more varieties were sown for the harvest of 1878.

Under the sympathetic guidance and encouragement of Dr. Townshend and President Edward Orton then head of the Agricultural and Mechanical College, other experiments were added. One of these, on the thick and thin seeding of wheat, was suggested by Dr. Townshend with the explanation that he had previously tried to have such an experiment made but the farm foreman, after the Doctor had left the field, set his drill at 5 pecks and sowed all the plots at that rate saying that was the right quantity and it was no use to bother with any other rate of seeding.

This experiment was made under favorable conditions and its results have been confirmed by the general average of a long series of similar tests that have followed. It seemed a rather unimportant matter to the young foreman who carried it out, who also had been taught that 5 pecks of seed was enough, but the experiment was made with an open mind. The outcome has shown that the difference between the 5 pecks of seed which was then the general rule over Ohio and the 2 bushels which have proved to be the most profitable rate for average soils, would probably add more than a million bushels annually to the total yield of the state, besides the extra seed used.

Early Experiments.

The Connecticut Experiment Station had been established in 1875, the first state supported agricultural experiment station in the United States, although some of the agricultural colleges had encouraged experimental research before it was begun in Ohio. The enthu-

siastic young director of the Connecticut Station, Prof. W. O. Atwater, who studied the work of the European experiment stations, was naturally interested in questions relating to soil fertility. He organized a series of cooperative tests with fertilizers in which the Farm Department of the Agricultural and Mechanical College, now the Ohio State University, was induced to take a part, and an experiment with chemical fertilizers, which had been furnished by Professor Atwater, was made on land near which the Chemistry building now stands.

The plots were small and the results contradictory, as is usually the case with first experiments with fertilizers, especially on undrained soil. It is merely worth mention as being probably the first such experiment made in Ohio.

Other experiments were attempted, including a study of the value of field beets as a feed for dairy cows; the feednig of pigs; depth of plowing, and the time for sowing wheat. All the work was crude, for the essentials of successful field and feeding experiment were then but little understood in America. The Rothamsted experiments were in progress, and their reports were the only guide in the English language to scientific work of this character, but aside from Dr. Townshend, very few of the University faculty took any interest in it. The bed of swamp muck lying west of the Botany and Zoology Building was a source of interest, but a sample taken to the chemical laboratory with a request for analysis was found a few days later on the ground under one of the laboratory windows. On the Board of Trustees were two practical farmers who were much interested in the work; but to some members of the Board, the university farm was a white elephant, and one member, a large land owner, proposed that it be laid down to grass and leased for pasture.

The wheat exhibits, made annually at the Ohio State Fair, continued to attract attention, and the number of varieties was increased each year. The farmers' lecture courses, which were held each winter in Dr. Townshend's lecture room, brought together a group of thinking farmers from various sections of the State, and the agricultural press lent a willing hand in forwarding the work.

Organization.

In 1877 North Carolina established an agricultural experiment station; New Jersey followed in 1880 and New York in 1881. The Connecticut, North Carolina and New Jersey stations, and later that of Massachusetts, were organized primarily as chemical laboratories for the control of the trade in feeding-stuffs and chemical fertilizers following the German conception of such a station. Several of the American agricultural colleges, however, were conducting experimental work similar to that being done in Ohio, and by the winter of 1881-82 the conditions were ready in this state for the organization of this work on a definite and permanent basis, and a bill introduced in the State Senate by Hon. J. H. Brigham passed without material opposition, establishing the Ohio Agricultural Experiment Station.

The Ohio station, like all other stations thus far organized, was placed under a separate governing board from that having charge of the agricultural college. But it was expected that the Station would find a home on the University grounds, and no provision was made for the purchase of land or the erection of buildings.

Professor William R. Lazenby had been called to the university in 1881, as Professor of Botany and Horticulture. He had asisted in framing the law establishing the experiment station, and by mutual agreement between the Board of Control of the Station, Professor Lazenby was appointed Director. The Station was permitted to use the field of about 30 acres in which the Observatory, Ohio Union and Oxley Hall

Experimental Wheat Plots on the University Campus in 1889

are now located, and two or three rooms in the small building now occupied by the Board of Health.

Before the establishment of the Experiment Station the inspection of fertilizers had been provided for in Ohio by a law lodging the work with the secretary of the State Board of Agriculture, so that the station was left free to devote its energies exclusively to scientific research in agriculture.

The first staff of the station consisted of Prof. W. R. Lazenby, Director; Prof. N. W. Lord, chemist; W. S. Devol, then an undergraduate in the University, botanist, and W. B. Alwood, superintendent of field experiments. Professors Lazenby and Lord devoted only a part of their time to the work of the station.

The initial appropriation to the station was $3,000, which was increased to $5,000 the second year, and continued at that sum until 1887, with the exception of an additional appropriation of $1,000 for the construction of a seed barn. These appropriations constituted the entire income of the Station, the proceeds of the crops produced being turned over to the University as rental for the land, an arrangement in common effect at other institutions.

In 1883 W. J. Green was added to the staff of the station as horticulturist, a position which he has held continuously for 34 years. In 1886 Professor Lazenby resigned in order to devote his

time exclusively to teaching, and Dr. Townshend was elected Director.

Influence of The Hatch Act.

In 1885 a bill was introduced in the National Congress by Mr. Cullen, of Illinois, providing for the establishment of agricultural experiment stations in connection with the agricultural colleges in all the states. This bill failed to pass but was introduced in the next Congress by Hon. W. H. Hatch, of Missouri, and became the law which has since been known as the Hatch Act.

Section 6 of this act authorized the legislatures of states in which agricultural stations had previously been established to devote the proceeds of the act to such stations, and this was done in Ohio.

The $15,000 annually appropriated to each experiment station under the Hatch Act gave opportunity for a large increase in the work of the Ohio Station, and the Board of Control, feeling it to be necessary that the Director should give his entire time to the Station's work, chose another Director, as neither Dr. Townshend nor Professor Lazenby was willing to sever relations with the university.

The station was reorganized under the Hatch Act, April 2, 1888, a technical defect in that Act having prevented it becoming effective at an earlier date. At a conference, previously held between the Board of Trustees of the University and the Board of Control of the Station, it had been agreed that the entire cultivated portion of the university farm should be transferred to the control of the station without rental. Every facility was given it for its work, consistent with the necessary work of the university, although at this conference Ex-President R. B. Hayes, then a member of the Board of Trustees, called attention to the fact that the growth of the city would eventually make this farm too valuable to be used for agriculture. President Hayes did not foresee that the growth of the city was to be a smaller factor than the growth of the University itself in making it impossible to devote the lands of the University which were adapted to work other than that of scientific field experiments.

At the time this agreement was reached the only buildings on the University campus, aside from a few dwellings and barns, were what is now the Administration building, a small power house and a little engineering building, a physics building and the present office of the Board of Health, then used by the Horticulture department of the university.

Agriculture Not Popular.

Up to that time there had been just two graduates from the "School of Agriculture" out of a total of 120 graduates from the university. The roll of students in all departments of the university for that year contained 343 names, of which eight were studying for the degree of Bachelor of Science in Agriculture, five for that of D. V. M., and 19 were enrolled in the short course in agriculture.

In fact, there was an undercurrent of suspicion in the institution at that time that those who were taking the agricultural course, especially the "short ags," were doing so because of lack of mental ability to master the other courses. And indeed it did require faith much larger than a grain of mustard seed to spend 6 years of time, with its attendant expense, to prepare for an intellectual vocation which thus far had furnished employment to but

(Continued on page 173)

TILE DRAINAGE IN RELATION TO SOIL FERTILITY

Factors That Should Be Considered in Planning Ditches

JOHN BEGG, Columbus Grove, Ohio

PROBABLY no single operation on the farms of the country has contributed so much to their productivity as has tile drainage. By this process thousands of acres of our most productive lands have been transformed from primitive swamps. Thru this means alone the rich level lands of northwestern Ohio have been changed from the most uncertain producers to the most reliable and productive farms of the state. Untiled lands that were practically worthless for general farming 50 years ago are now changing hands at more than $200 per acre.

Machines Secure a Perfect and Uniform Grade

Land that is well tiled is almost proof against wet seasons and is less susceptible to injury during dry seasons. The mechanical condition of the soil is radically changed for the better. A water logged soil is also cold and while it may contain the same amounts of plant food before tiling as after, these elements of nutrition are not available. This is manifest in the difference in quality of the products of such lands. Not only is the quality inferior to that grown on land that is thoroly drained but the quantity is greater under the same conditions.

Both of these facts were plainly visible last year in a field of wheat that we noticed at harvest time. The owner who was driving the binder stopped long enough to remark that the difference in yield on the drained and undrained parts would have paid for the tiling. This is no exceptional case under present conditions.

The effects of under drainage do not stop with the land itself but they influence every operation on the soil as well. Fertilizer of any kind, whether barnyard manure or the commercial article, will scarcely ever give the same results on land that is wet as they do on land

that is well drained. Many times we have seen barnyard manure rendered practically valueless by being applied to soil that was too wet to farm right.

Ditches Save Time.

Tiling is also a time saver for the farmer. On a well drained farm work can be begun much sooner in the spring or after a heavy rain during the season for cultivation. This is no small factor when labor is so scarce and high in price. We have seen instances where farmers who had their land well tiled would be nearly done plowing for spring crops before those whose land was not so improved could begin. Besides, those whose operations were delayed never did get their soil in the same tilth as where it was drained. Well drained land will always work much easier and require less cultivation to get it in the proper condition for the crops than where it is allowed to dry out in the usual way.

But we do not need to enumerate any more of the good results that come from a liberal use of drain tile. All anyone has to do to become convinced of the truth of the above statements is to observe the operations and yields on lands that are drained and compare them with the same quality of lands that are not drained. And yet there are people who "can not see it in that way." They go plodding along in the old way trusting to luck but hardly ever getting anywhere as farmers. However this class of farmers is becoming scarcer every day. Thru the teachings of scientific men at the agricultural colleges and the results obtained by field work at experiment stations together with the numerous successes on the farms of the country, the great majority of farmers look upon tile drainage as a necessity.

The older a country becomes and the longer land is used for growing crops, the greater the necessity for artificial drainage. A still broader view may rightly be considered in connection with this method of soil improvement. This is the improvement in a sanitary way which is more manifest in the level sections of the country. It also is a valuable asset to the general public. The man who can double his production by tile drainage has materially added to the value of the real estate in that community and has become a public benefactor.

Ditching Machine.

The work of laying tile is one of the most particular processes on the farm. So many things are to be considered in this operation that a little neglect or carelessness in any one of them may render the whole system useless. The danger of neglect thru carelessness or mistake has been reduced to a minimum by the introduction of the ditching machine. This method is so far ahead of the old way of hand digging that there is no comparison between the two. This method secures a perfect and uniform grade and the work can be done largely during the fall. The work is finished as rapidly as the ditch is made thus giving an opportunity for thoro inspection of the work before any tile are covered.

Every inch of fall can be utilized by this method thus giving another advantage over hand digging. But if there were none of these advantages to be gained by machine digging the extreme scarcity of labor would warrant the purchase of a machine. So the introduction of this one machine has been a great factor in promoting thoro drainage of farm lands.

Proper Depth.

The proper depth to lay tile is largely

determined by the depth of the outlet, and the character of the soil in which it is laid. When tiling land that has a hard tenacious subsoil the tile are laid from 18 to 24 inches deep. This refers to the small tile. In land with a porous subsoil they are laid at a depth of from 2½ to 3½ feet. All other things being equal, the deeper the tile are laid the farther they will drain. Where the outlet will permit and the subsoil is right, tile can be laid deeper and will naturally drain farther so that fewer drains are required. On the other hand, where they are laid more shallow the drains must be closer together to get thoro drainage.

The general practice since ditching machines are used is to lay out a system of parallel drains from 3 to 6 rods apart and as deep as the ground will permit. The size of tile to use must be determined by local conditions and the judgment of the owner. In this connection we wish to suggest that there is more danger of using tile that are too small than too large. Twenty-five or thirty years ago many used tile of 2 and 3 inches in diameter, but these small sizes have been discarded. Four-inch tile is the smallest size made in some factories.

Under present agricultural conditions tile drainage is almost imperative. Scarcely a season passes that does not at some time in the growing season damage the crops on account of poor drainage. The only safeguard against damage to crops at such times is to have the land well drained. It will pay in dollars and cents if the farmer has to borrow the money to tile his land under present conditions. We regard tile drainage as one of the greatest assets a farmer can have, one that not only safeguards against loss but insures success in all his operations with the soil.

The Man Is Still an Important Factor in the Process

A LITTLE WHEAT PHILOSOPHY

Phosphorus, Manure, Lime and Clover Prove Essentials in Crop Production in Ohio

L. L. RUMMELL, Wooster, Ohio

PHOSPHORUS, barnyard manure and lime form a triumvirate that decide what crop yields will be on most Ohio farms. When they are used on crops in proper rotation and drainage is taken care of, clover crops are assured. Ample provision is thus made for the supply of needed plant food in economical, practicable form. A few sections of western Ohio do not feel the need for supplying all these materials, but the impoverished soils of the eastern part respond well to these treatments and many soils of western counties are also becoming deficient in the same materials as crop production continues.

Manure furnishes nitrogen and potassium in abundance and its nitrogenous plant food is supplemented with that furnished by the legumes. The deficiency of manure in phosphorus is met

Wheat Unfertilized (left) and Treated With Acid Phosphate (right)

by purchases of acid phosphate or raw phosphate rock, the only fertilizing materials that are profitably added to Ohio soils today. This reinforcement of the

Wheat Manured (left) and Untreated (right)

manure makes it a balanced food for crops. Such a rational system of feeding crops requires the purchase of little other commercial plant food and crop yields may be expected to remain at a high level of profitable production.

If any other chemical fertilizers are bought, they may be best applied to wheat, leaving corn to utilize manure reinforced with phosphorus. The other crops of the rotation may then be left unfertilized to garner their food from the leavings of the corn and the wheat.

The importance of these factors in crop growing is well illustrated in the wheat crop grown in the 5-year rotation of corn, oats, wheat, clover and timothy at the Ohio Agricultural Experiment Station this year. This rotation was started in 1894 and the crop this year is therefore the twenty-fourth harvested in this experiment.

Unfertilized wheat averaged 12.82 bushels per acre. The addition of 160

The Result of Proper Rotation, Manure, Lime and Fertilizer

pounds of acid phosphate has raised the yield to 24.62 bushels. This increase in yield was the highest from any single fertilizing component.

Plot 18, receiving 8 tons of manure per acre on wheat, yielded 37.46 bushels per acre, an increase of 23.78 bushels from this application. This yield was the highest in the entire series of plots in this rotation this season.

The same plot shows strikingly the value of lime even on wheat. The unlimed end produced 40.42 bushels. The greatest difference in favor of lime, of course, will be noted in the clover crop following wheat.

An increase of 4 bushels of wheat per acre was obtained in the entire rotation from an application of 2 tons of ground limestone to corn. The unfertilized land averaged 14.98 bushels per acre where limed and only 10.65 bushels where no lime was added. On fertilized land the yield was increased from an average of 25.04 bushels to 29.49 bushels by lime.

The combination of all these treatments is demonstrated in another series of plots at the experiment station. Eighty-eight plots in a 4-year rotation with corn, oats and clover averaged 44.88 bushels per acre. The average yield of wheat in these four 10-acre fields for the last 13 years has been 35 bushels per acre. The same land with-

Young Clover in Wheat Stubble on Limed (left) and Unlimed (right)

out treatment of manure, lime and fertilizer yields 12¾ bushels.

SOIL STUDY AT OHIO STATE

How It Has Been Correlated With the Work in Agricultural Chemistry

FIRMAN E. BEAR, Ohio State University, Columbus, Ohio

AGRICULTURAL chemistry may be defined as the application of the principles of chemistry to the science of agriculture. It may be said that there was no scientific agriculture until after agricultural chemistry had developed. Baron von Liebig was the first man who was really entitled to be called an agricultural chemist. In 1840 he wrote a book entitled "Organic Chemistry in its Application to Agriculture and Physiology." In the preface of this book he writes:

"I shall be happy if I succeed in attracting the attention of men of science to subjects which so well merit their talents and energies. Perfect agriculture is the true foundation of all trade and industry—it is the foundation of the riches of states. But a rational system of agriculture cannot be formed without the application of scientific principles; for such a system must be based on an exact acquaintance with the means of nutrition of vegetables, and with the influence of soils and action of manure upon them. This knowledge we must seek from chemistry, which teaches the mode of investigating the composition and of studying the characters of the different substances from which plants derive nourishment."

Agricultural chemistry today is a very broad subject. It not only includes the science of the "nutrition of vegetables" and "the influence of soils and the action of manure upon them" but also includes the science of animal nutrition and in addition to these the chemical processes involved in the great manufacturing industries which have to do with the preparation of plant and animal products as food for human consumption.

In answering the question "What is agricultural chemistry?" it will be necessary to define it also in terms of what we are able to present to students out of the whole field of this science in the small amount of time allotted to us to teach a general course in the subject. Evidently only the high points can be touched in a course of this nature. It is also necessary to take into consideration the status of the students' chemical information when he registers for this course. The instructional work must be so organized that it begins where the students' previous course in chemistry stopped.

Normally the students in agricultural chemistry are sophomores. Their chemical training consists in a course in general chemistry of 10 hours. This course is on the fundamental hypotheses, theories, and laws of chemistry including a survey of the inorganic chemical elements and compounds. The laboratory work consists in a study of some of the chemical laws, the preparation of certain elements in the pure state and the qualitative separation of the inorganic chemical elements from laboratory mixtures of their compounds. Assuming that the student is familiar with the ordinary chemical laws and theories and that he has some laboratory experience in elementary qualitative analysis we outline our courses to take up his training at this point and to direct his attention to the broad field of chemistry in its application to agricultural problems.

The chemical problems in plant and animal life are in a large part organic in their nature. It is thot best that the student take up a study of organic chemistry at this point in order that he may be able to understand the processes involved in nutrition. Food products are made up largely of sugars, starches, fats and proteins and it is desirable that the student study the nature of these substances in the light of our modern chemical theories. But the field of organic chemistry is so large and so many of the compounds which are known and studied in organic chemistry are so far removed from having any direct bearing on the subject of agriculture that it is necessary to eliminate from the course all consideration of those compounds the knowledge of which is not fundamental to an understanding of the problems of agriculture. The student is,therefore, relieved of a very considerable burden of study by having the course given by men who are interested in the science of agriculture and who know just what part of the course usually given in general organic chemistry can be eliminated to advantage. The amount of time given to each subject in the college of agriculture is so short as to demand that the work be so organized that the student can secure the greatest amount of information in the shortest possible time.

The first semester's work consists of a general survey of organic chemistry in its application to agriculture, including a study of the fundamental principles of plant and animal nutrition. The laboratory work is coordinated with the lectures in order to assist in clinching in the students' minds the essential facts under consideration. The laboratory work includes an analysis of the ash of plants for their inorganic constituents,

View of Illinois Experiment Station Plots

a study of the composition of feeding stuffs and the analysis of milk. These analytical processes are of course preceded by a study of such elementary principles of quantitative analysis as are necessary for the complete understanding of the work.

The second semester's work is devoted entirely to the study of soils and soil fertility problems. Each student is asked to bring in from his home farm a sample of soil. This soil sample is subjected to a careful laboratory examination and quantitative determinations are made of the more important soil constituents. Analyses are also made of samples of fertilizers. This laboratory work is arranged to coordinate

with the lectures on soil fertility which take up a discussion of the means of making soils productive.

It will be remembered that the statement was made that the length of time devoted to agricultural chemistry was so short that only the "high points" in the subject could be touched. But there are students in every class who desire to know more about the science of agricultural chemistry in its relation to special industries such as dairying, stock feeding, fruit growing, food manufacturing processes, fertilizer manufacture, agricultural limestone industry and many others. Courses are designed for such students which will enable them to become thoroly acquainted with the chemistry of any one of these special industries.

The question which is most prominent in the student's mind probably is, "Of what interest or value is agricultural chemistry to the man who expects to be a farmer?"

It is somewhat difficult to answer that question without discussing the whole subject of the value of a college education. Why is a college education valuable? There are four outstanding reasons why a man should have a college education.

1. It broadens his horizon and makes him more cosmopolitan in his point of view. His opinions are the result of his having studied the problem from many different angles.

2. It enables him to choose more intelligently from the things that are worth while and to make himself a man who has associated with the best in literature, science, art and music. A man is a part of all the things with which he comes in contact and it is worth while to choose the best because of its reaction on the chooser.

3. It increases his efficiency. The man who is educated knows all that the ordinary individual knows and in addition he is able, when new problems arise, to more quickly see what the method of attack should be. A college education makes a man much more alert both as to the possibilities and as to the solution of the tasks which present themselves in these new possibilities.

4. It makes him of more service in the community in which he lives. One thing worth while in a man's life is the feeling that no matter what arises he is able to make his time and efforts count to best advantage. In order to assist in any worth while enterprise he must have the weapons of attack. A keen intellect well-cultivated makes a man "stand out" in all movements which have to do with the betterment of society.

Now the question is: Will agricultural chemistry be of any assistance to such a man? The men who have planned the agricultural college courses in the leading agricultural states have, almost without exception, placed agricultural chemistry among the courses required of all students. Apparently there is an almost unanimous opinion among agricultural teachers that agricultural chemistry is fundamental to an intelligent understanding of the problems connected with the growing of plants and animals.

An agricultural college is not the place in which to learn the art of farming. Students often object to the first semester's work and to the laboratory part of the second semester of agricultural chemistry on the ground that it is not practical. The structural formula of organic compounds seems far removed from the feeding of hogs; the

weighing of gram samples on an analytical balance, which is so sensitive as to be effected by a hair, seems hardly worth while to the student who expects to do his weighing by the pound and often lets the purchaser do the weighing for him.

But it must be remembered that practical agriculture, if by that is meant the art of agriculture, is gotten on the farm. The man taking the agricultural course is supposed to know how to plow, milk, shock wheat and put feed in the horse troughs and mangers. He came to the university to learn the scientific principles involved in balancing the ration for animals; the fundamental to an understanding of how to grow wheat worth shocking; the information which will enable him to solve the problems which arise in the feeding of plants and animals.

The professional opportunities in agricultural chemistry were never better than now for the man who is thoroly prepared. Within the last two months we have been asked to recommend at least six men in agricultural chemistry for positions paying from $1,000 to $2.250 per year and not a man was available for any of these positions. Agricultural chemistry is still in its infancy. We are just at the beginning of the period of demand for men who are trained in the principles of chemistry and who are interested in the greatest of all sciences, agriculture.

There was a day when any man could farm but it is past. There are many men who are still living on farms who are not successes and who would be better off as day laborers. The farmer of the future to be a marked success will be thoroly trained in the science of farming.

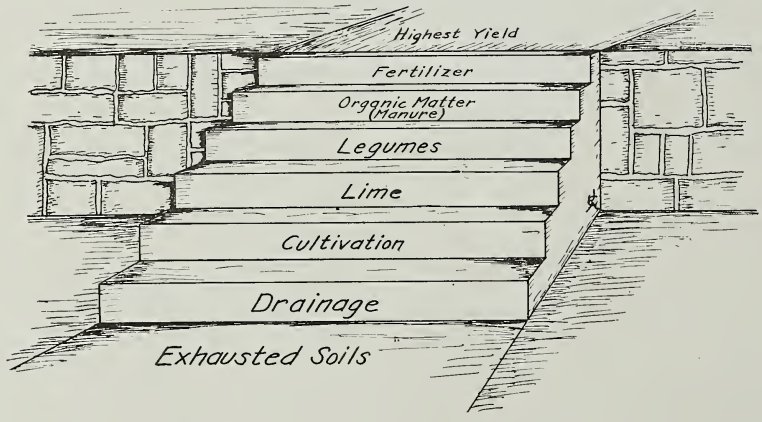
There was a day when any man who had seen inside of a book on chemistry could be a chemist and that is past. There are many men who are now in chemical laboratories who would make better clerks than chemists. The chemist of the future must be thoroly pre-

Main Building at the Rothamsted Experiment Station, London, England

pared in order to make a success. Only ordinary salaries are available for ordinary men. There is no limit to the salary which a capable chemist can command. There are opportunities in teaching chemistry and soils in agricultural high schools, in colleges and universities. A great number of research problems in agricultural chemistry are waiting to be solved by the man who is prepared. The great commercial concerns which deal in the products of the farm or manufactured products for use on the farm are always looking for men. A member of the department of agricultural chemistry and soils was offered $5,000 a year with promises of an increase in salary by a commercial concern within the last two weeks.

But it must be remembered that only a relatively few men are qualified by temperament to take up the type of work demanded of those who would serve in this field. To such as take a delight in the science of chemistry, who enjoy doing the difficult things in the laboratory, who delight in working out problems which seem impossible of solution, agricultural chemistry offers a field of opportunity both for financial reward and for the keenest enjoyment.

For those who feel a desire to specialize in agricultural chemistry we would like an opportunity to offer a few suggestions in the selection of courses to fit them for their chosen profession. The department of agricultural chemistry and soils is now prepared to take a man who has had only the elementary course in chemistry and give him the preparation which will fit him for a position either as a dairy chemist, a soil or fertilizer chemist, a plant chemist, a pure food chemist or a nutrition chemist. We are also prepared to assist the man who wishes to specialize in animal husbandry, dairying, crops or horticulture by giving him the chemical courses which will enable him to become most efficient in his chosen field. We would ask, therefore, that any who aspire to become agricultural chemists make it their business to consult one or more of the members of the department of agricultural chemistry and soils before deciding their schedule of courses.



CONSIDERATIONS OF SOIL BIOTA

Distribution and Influences of Bacteria in the Earth's Surface

AUGUSTO BONAZZI, Ohio Agricultural Experiment Station, Wooster, Ohio

A STUDY of soil biotic conditions is such an intricate study of so many regulating forces that it can not be successfully attacked unless a clear conception is formed of the soil as an environment. The soil constitutes an environment for the organisms lodging in it, so that we are justified in giving it our attention from this standpoint. Before proceeding with the treatment of our subject we shall establish the point of vital importance to this treatmen, namely: that the soil actually constitutes the environment for the soil biota.

In 1840 Justus von Liebig in his "Organic chemistry applied to physiology and agriculture," expressed his views on plant nutrition in the following axiom; . . . "It is the inorganic world that constitutes the chief source of food for plants" . . . This axiom forms the foundation of what has since been known as the "mineralistic theory of plant nutrition."

In 1855 this same scientist modified somewhat this dogmatic statement; he gave to the world a series of fifty agronomic aphorisms which have since been the basis of rational agriculture. Those that concern us at present are the ones numbered 14 to 18 which can be summarized as follows: "The decomposition of manure in the soil leads to the formation of carbonic acid and ammonia. The manure, then, not only furnishes the plant with a definite quantity of mineral and atmospheric foods, but, by means of the products of its decomposition it renders the soil capable of furnishing the plants with substances insoluble in water, making them utilizable in a larger measure than they would be in the absence of putrescible organic substances. Of two fields of equal mineral composition the one possessing a richer source of carbonic acid, i. e., putrescible organic matter, is the most fertile." . . .

Thus we see that at such an early time in the history of agronomic science a conception was formed of the modus of nutrition of higher plants; the fact was established that manure must undergo decomposition before it is assimilated. Later it was found that soil bions were responsible for this decomposition.

The importance of the statements of Liebig will be realized when we search into the meaning of the words **autotrophism** and **heterotrophism.** Physiologists have taken these words to designate two different states, or conditions of life, diametrically opposed and forming the extremes of a chain of interlocking links, each link merging into the other by a gradual change; **autotrophism** to indicate that condition of life which requires a synthesis of organic substances from atmospheric CO_2, water and soil mineral salts, and the subsequent respiration of these synthesized substances; **heterotrophism** to designate that condition of life which requires the utilization of already-synthesized organic substances. As already mentioned the state of **autotrophism** merges into a state of **heterotrophism** in the scale of organized nature and in some cases we can observe the presence of both these conditions in the same organism, contemporaneously.

From what has been said it is seen that an organism living in a state of **heterotrophy** is dependent directly or indirectly on that group of organisms

which at some time in its cycle lives an **autotrophic** life. In a study of soil biotic conditions it will be necessary to keep this point in mind. We have in the soil such a large group of organisms (animal and vegetable) which is strictly dependent on organic substances that we must assume the members of this group to be dependent for their life functions on that other group of organisms which is capable of synthesizing organic substances.

The above discussion makes it necessary for us to classify the soil inhabitants in two groups as follows:

Autotrophic organisms[1] ... { a flowering plants; b chlorophyll bearing, flowerless plants; c autotrophic microorganisms

Heterotrophic organisms ... { d fungi and bacteria; e mycetozoa, protozoa, nematodes, anellideae.

In soils the distribution of organic matter which serves as food to the **heterotrophic** organisms, derived directly or indirectly from death of **autotrophic** organisms, should be considered from two separate standpoints; quantitative and qualitative. The quantitative distribution is conditioned by the aptness of the soil to the penetration of solutions, its capillarity, the volume of capillary spaces, the wetting qualities of the soil mass, the power of the soil in the transportation of solutions, its absorptive capacity and meteoric conditions. The qualitative distribution of such food substances is conditional by their solubility, the absorptive capacity of the soil mass, meteroric conditions and the nature of the soil covering.

The result of the integration of all these conditioning forces leads to the distribution of the organic matter in the soil, which Declaux has pictured in a diagram similar to the one here presented.

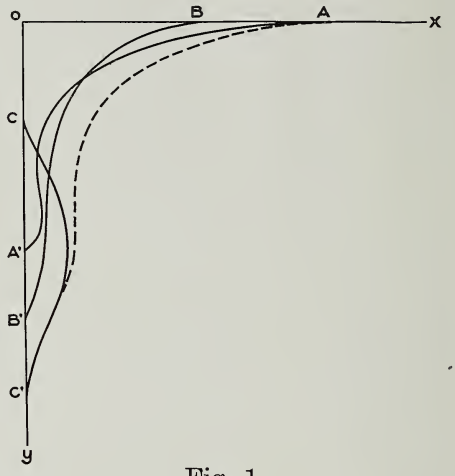


Fig. 1.

In the above diagram, the axis OX represents the quantity of substance to be found at the depths represented by the axis OY. Each one of the lines AA', BB', CC' represent the quantitative distribution, with increasing depths, of particular compounds A, B, C, decreasing in solubility from C to A.

It stands to reason: (1) that the number of such compounds is an indefinite value, (2) that the relative abundance of the different compounds may vary in different soils. (See causes conditioning distribution.) Notwithstanding these two last possibilities, the diagram above shown represents the distribution of organic matter in the average soil. We must agree with Ducleax . . . "that organic matter most unchanged in its

(1). That this is not an economic classification is evident, but such an economic classification has been so often attempted that the reader is referred to standard books on soil biology. Unfortunately soil biology has been limited to the study of some "special" function of only a comparatively small number of organisms of group c and d, so that we are unable to treat of the biology of organisms belonging in groups a, b, and e, with regard to their relation to soil.

organization, the most colloidal, will lodge near the surface of the soil; it is here that the organisms active in its transformation will be most abundant. Conversely at the other extreme in depth we find those organisms which utlize the materials resulting from the decomposition and dissolving of the organized organic matter."

The mutual influences of soil biota are gradually changing with increasing depth. The actual quantitative distribution of the soil biota follows the distribution of organic matter as is shown, in our diagram, by the dotted line AC'.[2]

In soils which bear plants with deeply penetrating roots, this distribution is slightly modified by the shifting of some of the superficial groups of soil bions to deeper layers; but the slow weathering in these strata, and the poor conditions of aeration, make this disturbing influence a relatively unimportant one.

Having briefly considered the vertical distribution of the soil bions and its direct relation to the distribution of putrescible organic matter, which serves as a source of food and energy, we shall make a general survey of their horizontal distribution. The conditioning forces above referred to play an important role here; above all we shall have to consider the qualitative distribution of organic matter and its effect on the quantitative-qualitative distribution of the soil biota. Typical cases are furnished by the variations in the nature of putrescible organic matter presented by forests, meadows, and agricultural plants. Extreme cases are peat deposits and desert lands.

That which takes place in the vertical distribution within a space of a few feet, requires a distance of rods and sometimes many miles in the horizontal distribution. The maxima of distribution and development may also be more pronounced and isolated. A diagram of that form of figure 2 may obtain; in which A, B, C, indicate three separate climax each with a distinct biota made up of various groups a, b, c, d; e, f; g, h, i, l. The quantitative-qualitative distribution is in this case indicated by

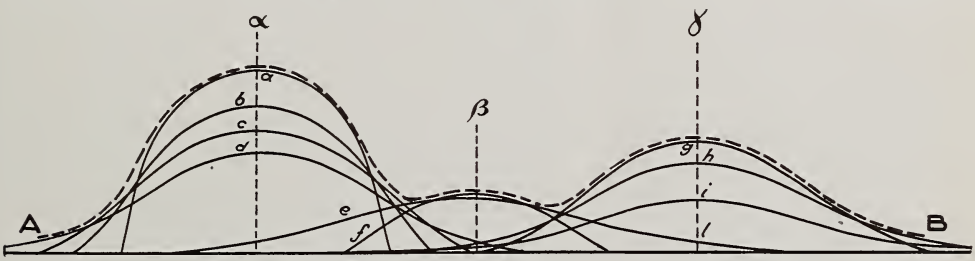


Fig. 2.

the dotted line AB tangential to the series of envelopes.

Apparent anomalies to the above generalizations are those **heterotrophic** organisms which at some time of their life cycle live in direct connection with **autotrophic** organisms. It is a common custom to classify these organisms as saprophytic, symbiotic and parasitic, but in the light of the above discussion we can see that this classification does not satisfy our logic. A classification of these organisms based on their relation to a particular **autotrophic** organism is important in soil biology, only in so far as it sheds some light on their action in and on the soil complex.

(2). Any attempt to the determination of the distribution of soil bions, made by the ordinary methods, is to be considered as relatively unprofitable in the light of the above discussion.

Disturbing influences on this distribution are exerted by the direct effect of **autotrophic** organisms on the life conditions of the soil **heterotrophic** bions; we are all familiar with the difference in soil conditions, flora and fauna, existing between a meadow, a forest, a heath and a cultivated field.

The methods for the study of distribution of the soil biota are not yet developed, but it must be hoped that no method shall be accepted as finally valid that does not take into consideration the actual environment presented to the soil biota by the soil. Many organisms are known to us only thru the one function of their life activities which we feel justified in naming their "**main**" function. Their other functions are partly or entirely unknown to us and likewise their relations to other organisms and conditions. The study of this "**main**" function has been prompted by an economic classification of the soil organisms, but it must be borne in mind that a study of "**all**" their life functions might show us that their "**main**" function loses much of its value and is really not the main function after all, but one subordinate to its other natural life activities.

Organic Matter in the Form of Weeds Is Expensive

WHAT WILL THE HARVEST BE?

Some Practices That Maintain and Increase Soil Fertility

W. W. BROWNFIELD, Marietta, Ohio

"WHEN the frost is on the 'punkin' and the fodder's in the shock" a feeling of self congratulation may be pardonable upon the part of the farmer who has been successful in producing large crop yields for the season and has either secured or has good prospects for securing a profitable income from his labors.

As the season advances, bringing shorter hours of daylight and an appreciation of the open fireplace, it is a commendable pastime, while thus enjoying the warmth of the fire, with a pitcher of sweet cider and a plate of Grime's Goldens or Rambos nearby, to engage in some reflections upon the reasons for profitable and unprofitable ventures of the season.

A farmer generally takes real delight in telling what he did to produce his good crops and evidences honest pride in taking one around to "look the place over." There is a large number of such farmers in the Buckeye State, and a visit to the farms of any of them is both a pleasure and a productive source of practical information. It is interesting to note the fact that a large number of these successful men are close followers of the Ohio Agricultural Experiment Station and the College of Agriculture.

John Smith is one of these successful fellows and is also congenial company. Perhaps we cannot do better than to spend an evening in front of his log fire talking things over. For a number of years he has been improving his farm and home until now it is a real beauty spot. It must be admitted that this "improving period" has been a time of deep concern to the neighbors who have been continually amazed at Smith's crazy antics, and knew for certain that his course was carrying him toward the poor house with the speed of an up river gale. Smith "thot himself smart, and a little better than anybody else," because what was good enough for them, did not satisfy him. Why, for instance, should they spray their apple trees? The poor defenseless little white worms needed something to eat and where was there anything so good for them as apples? To be sure they wouldn't be foolish enough to waste money in spraying! Would they pay two dollars to breed to Smith's registered bull when they could breed to Sam Jones' bull for fifty cents? Would they buy any eggs from his pure bred chickens, headed by a Tom Barron cockerel, at one dollar a setting? "Really, what do you take us for anyhow?"

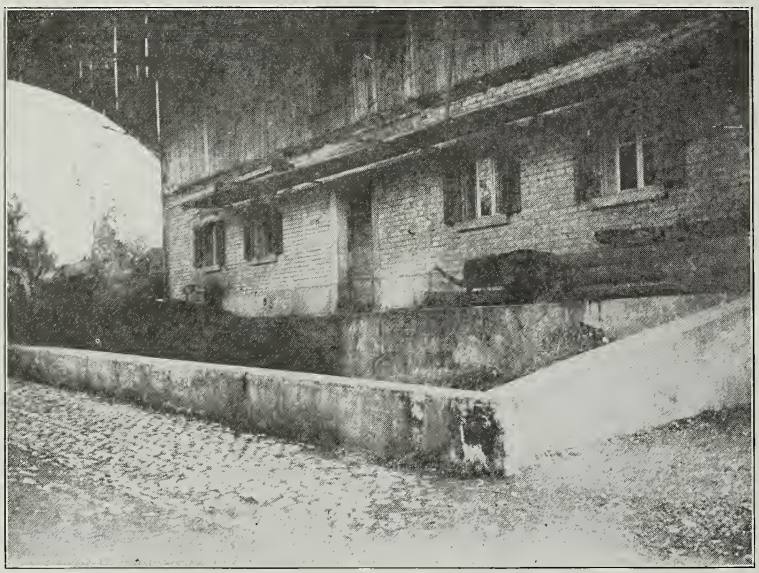
We haven't any more time to spend with the neighbors, if we want to enjoy Smith's company, so will go over right away. He is cordial as usual and leads us into the large living room lighted with acetylene. His good wife has brought in the cider, apples and pumpkin pie and we are in for a jolly good time.

When he first moved to the farm the crops were poor. Clover would not grow, and he felt that he must have it. A trial of lime convinced him that that was the thing needed to secure a good stand. Men who were interested in selling, insisted that "manufactured" lime with a fancy name hung on it, was the only kind to buy. Study of experiment station reports convinced him that if it was possible to secure it locally,

raw ground limestone would be his most economical form to buy. He has secured excellent results from the use of two tons of ground limestone per acre, when ground finely enough that all of it goes thru a screen ten bars to the lineal inch and 50 per cent or more thru a one hundred mesh screen. He has not found any great difference between the "availability" of burned lime and ground limestone when the latter is thoroly worked into the soil by use of the disc harrow. There is no longer difficulty in growing clover and it is the aim to grow it in the rotation regularly once in four years.

The common practice in the community has been to throw the manure from the stables out under the eaves until there was no longer room for any more, and then reluctantly haul some of it out to the fields thus seriously inconveniencing the myriads of flies which had come to consider the manure pile as personal property and had for some time been using it as a nursery and "way station" on their way to the dinner table in the farm home.

Smith, being an odd sort of fellow, formed a decided dislike for this method of handling manure, and vowed he would do differently. He determined to haul all manure directly to the field in so far as practicable, and when this could not be done, to make use of the manure pit. Also, he was told that failure to save all the liquid manure was subjecting him to a big loss and that it would not take very long to save enough plant food by the use of concrete floors to pay for them. Being a business farmer, it did not require very long to get the concrete floors. He has found since that time, that such a floor is not only a convenience but a necessity and that he derives far greater benefit from the manure produced by a given number of animals than do some of his neighbors who scoff at the book farmer's "high-falutin" doings.



Barn in Germany Showing Method of Storing Manure

A part of the Smith farm was too wet for farming, and had previously been

considered as not worth bothering about. It happened to be near the public road and convenient to the buildings, so Mr. Smith meditated as to what he should do with it. After careful use of his lead pencil and consultation of authoritative evidence on drainage he decided to try what benefits drain tile would confer. Accordingly he secured the services of a drainage engineer from the college of agriculture and had levels taken to establish a grade for the drains and to plot the arrangement of them. The neighbors were exceedingly curious as to what was going on, and began to have visions of high priced land on their farms, because a "new railroad" was going thru, and "would have to pay for it if it got to go thru their place." The drain was laid in due time and has been a profitable investment. What was once practically unproductive land, now grows the largest crops on the farm. Smith says no one with wet land can afford not to drain it. Some are still skeptical and refuse to be convinced and will doubtless continue thus until some day they realize that for many years they have been dead and the new generation will step forth and take hold with a business vision.

The soil on Smith's farm, like a large part of the soil in Ohio, showed benefit from the use of fertilizer. Agents interested in the sale of fertilizers were quite anxious that Smith should use large quantities of such fertilizers as "Special Wheat Grower," "Double Value Corn Grower," "Beats 'em all" potato fertilizer or "Wonder Crop Accelerator," but Smith saw the hook dangling from the line, concluded it was not the "open season" for suckers and refused to bite. It made no difference to him when it was pointed out that several carloads of such fertilizer were sold in that community every year. He expressed himself and justified his positions as follows: The use of ready mixed fertilizers is discouraged by the Ohio Agricultural Experiment Station and College of Agriculture; every dol-

Oldest Fertilizer Plots in America—Pennsylvania Station

lar invested in 16 per cent acid phosphate at the West Virginia Station has given a net increase of $3.63; nitrate of soda and acid phosphate applied in combination gave 2¼ times as much increase per acre as acid phosphate alone, but the net profit per dollar invested was only $1.19; nitrate of soda, sulphate of potash, and acid phosphate applied in combination have given three times as much crop increase as acid phosphate alone but the net returns per dollar invested were but $1.32.

Results at the Ohio Station from use of fertilizer in five year rotation covering a 20 year period, show a net profit or loss for each dollar invested as follows:

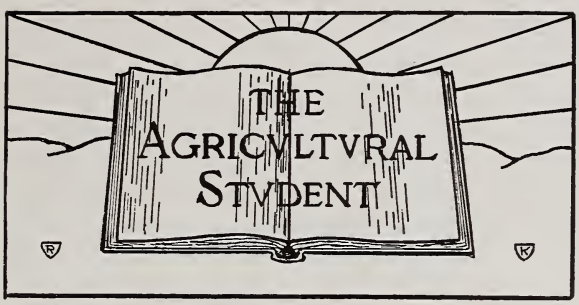
Acid Phosphate—320 pounds per acre,—Gain $5.33
Muriate Potash—260 pounds per acre—Loss ..... .11
Acid Phosphate—320 pounds and Muriate Potash, 260 pounds—Gain 1.71

The results at each of the stations point strongly toward acid phosphate as the proper fertilizer to buy. Larger yields may be secured from the purchase of other fertilizers but the profit from their use is not so great owing to the much higher cost per ton and the increased cost per acre application.

From the farmer's point of view, it is not what fertilizer he can use at some profit, but what fertilizer he can use at the greatest net profit per acre from the amount of money he can afford to spend for fertilizer. From the point of view of some agents and field men it is a matter of how much fertilizer the farmer can be induced to buy at the greatest profit to the manufacturer.

The director of the Ohio Experiment Station, the chief of the agronomy department of the station and the soils department of the Ohio college of agriculture are united in the recommendation to farmers that they refrain entirely from buying "complete," ready-mixed fertilizers. Their advice is that where the use of a fertilizer containing nitrogen, phosphorus and potash is warranted, the materials be purchased separately and mixed on the farm. Then the farmer will know what he is using and approximately what the availability is. At the present time, the purchase of potash salts is practically out of the question so that it is costing him more than he is justified in paying. No one will question the necessity for having plenty of nitrogen and potash present in the soil but the station and college men urge that this be secured thru careful saving of manure, growing of legumes, and by having the soil well supplied with organic matter.

We shall take leave of Mr. Smith here, assuring him that we have spent an enjoyable and profitable evening, and expressing the hope that continued prosperity may be his.



OF
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A MEDIUM FOR EXCHANGE OF IDEAS BETWEEN COLLEGE AND FARM

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COLUMBUS, OHIO, OCTOBER, 1917.

EDITORIAL

DIRECTOR CHAS. E. THORNE.

When considering any phase of soil fertility that concerns the agriculture of Ohio there is always one man that stands out as an authority on every question. No person who has become acquainted with scientific methods of farming fails to recognize the sound judgment and the broad vision of the Director of the Ohio Agricultural Experiment Station.

The article which he has written for this issue of The Agricultural Student commends itself to every reader. One cannot read the article without admiring the reserve of the writer. He has not told of the many trials and troubles that he has borne as director but has only given a hint of some of the obstacles that had to be overcome before the Ohio Agricultural Experiment Station could take its place as one of the best institutions of its kind in the country.

We doubt if the people of Ohio fully appreciate the work that has been done under his leadership. Many of them have never been on the Station farm and others do not receive the benefits that should come from such labors. Everyone is welcomed at the farm and the hospitality and genial disposition of Mr. Thorne is one of the most pleasant remembrances of such a visit.

If you have never visited the Experiment Station at Wooster or your county experiment farm, read this article in order to get a clear idea of the history and magnitude of the enterprise and then begin to plan a trip to see the results that have been accomplished by the tireless, persistent efforts of Director Thorne.

CLEAN UP THE FARM.

Everyone is now making plans for next year's crops but there are many who will forget to include the destruction of those insects which might live thru the winter and emerge next spring to feed upon the young plants. The bumper crops which all like to harvest will be diminished by these insects which pass the winter in the remnants of the preceding crops. Burning the refuse is one method of control.

Cabbage lice, cucumber beetles, squash bugs, curculios, leafhoppers and flea beetles are only a few of the insects that pass the winter in this fashion. Many of these can be destroyed by burning the garden and crop refuse. It is often possible to make trap heaps with a part of the refuse and then burn these in the late fall. This method should be used after all other trash has been destroyed. Not only are the insects destroyed but those organisms that cause such fungous diseases as potato blight and onion smut are checked to some degree.

The destruction of this refuse has another beneficial effect since it serves to make the farm look beautiful and clean, meriting the favorable comment of passersby. It also shows the self respect that a farmer has in doing something to add to the interest and attractiveness of his home.

SAVE THE MANURE.

The plant food of manure is so readily soluble that great care should be taken to keep it from being leached away. Where large quantities of manure are produced a cistern for its storage may be advisable but under ordinary conditions an ample supply of bedding will absorb the liquid plant food and it may thus be held until a suitable time for hauling. Some farmers still persist in hauling the manure to the field and unloading it in piles to be scattered at some future time. In this case the rains wash out much of the plant food and altho it enters the soil of the field, it is all in one place just beneath the pile. This makes the field uneven in regard to fertility and some time is necessary to distribute the plant food evenly thru the soil.

A great loss also comes from feeding in open lots where a large per cent of the manure is exposed to the rainfall. A three year test at the New Jersey station showed that fresh manure gave 40 per cent greater increase in crops than did the leached manure. Considering the results of this test as well as those at the Ohio Station and the present price of fertilizers we can afford to use some care in the preservation and handling of the manure.

REMEMBER THE WOMEN.

No doubt American farms and American methods of farming are improving as fast as could be expected. It is evident that farming has lost much of the drudgery of former years. The reapers have replaced the sickles; the tractor is lessening the work of the horse; milking machines are doing the work of many men and improved machines of all kinds are being made to lighten the labors of farmers.

But what about the tools and labor saving devices for the home. Plenty of them are made but their use is not as common as that of the modern machinery. The wives and mothers are still laboring, in many cases, with the same necessities that their mothers used several years ago. The power washer, the fireless cooker, the refrigerator, electric lights and other useful conveniences

may mean more to the happiness of a farmer's life than the machinery which he is so willing to buy.

Before purchasing another implement, make an investigation about the house to see if there is not a greater need for something there. Extension men at the Ohio State University found that one woman in Ohio was walking 180 miles per year while getting the water for the home when $60 would have paid the entire expense of piping the water into the kitchen. The woman in the home deserves a square deal on this labor saving proposition.

OUR FRONT COVER.

The front page of this issue contains a picture of what is possibly the best example of scientific farming in Ohio. This is a part of a 10 acre field that has averaged 75 bushels of corn per acre for the last 13 years. This was made possible by proper rotation, fertilizers, lime and manure. The picture was taken on the Ohio Agricultural Experiment Station showing the city of Wooster in the background.

TRAINING FARM LABORERS.

No problem that faces the farmer today is as serious as the scarcity of labor. The large number of men who have been taken off of the farms into war service, together with those who have left the farms for the higher wages in the factories, will cause the problem to become more serious before the crops of 1918 are harvested.

Farmers are partly to blame for this condition of affairs. Last summer many boys from the cities tried to get work on the farms but were rejected because they had never had any farm experience.

The government is spending thousands of dollars to train men for the army service. Farmers should consider it a patriotic duty to spend a few hours in training young men for farm labor because the soldier must be supported by those who are in the fields.

Even tho farmers need immediate help that help must be trained before it is efficient. And the only place to secure that training is on the farm.

NATIONAL DAIRY SHOW.

As we go to press The National Dairy Show is coming to a close. Every day has been one of great interest to the dairymen and every night has delighted the lovers of fine horses. Excellent animals have been shown in all of the classes of horses including the saddle and harness horses as well as the ponies and jumpers. The exhibit of draft horses contained some of the best specimens in America today.

The dairy cattle exhibit has been pronounced by some prominent men as the best that has ever been gotten together in America. The cows came from New Jersey and California; from Texas and Minnesota and from many of the central states.

Farm machinery of all kinds was shown bringing home the lesson that the farmer must equip his farm with the best labor saving implements if he is to keep up with the procession of successful farmers. Dairy machinery was shown in abundance and many went home with a larger vision of what the dairy industry is and what it means to the country.

No one can tell what the Dairy Show has meant or will mean to the industry in Ohio but it is hoped that it can be held here again next year when the people may better see and realize its great influence and helpfulness.

EXTENSION SERVICE IN SOILS

What Is Being Done For the Farmers of Ohio by This Department

MYRON A. BACHTELL, Ohio State University, Columbus, Ohio

"THE greatest thing in this world," said a noted preacher, "is to be able to take people as they are and lead them to where they should be."

It was June and farmers were busy making hay. The county agent and extension specialist in soils had just left the farm of Mr. Brown. They had found Mr. Brown in the hay field where the last load was on the wagon, consequently Mr. Brown had time to talk. He wanted to show his oat field and his corn but most of all he wanted to tell about the clover meadow he had just finished cutting. "As much hay here on 12 acres as my neighbor across the road will get on 35," was the way he told it. Phosphorus and lime had turned the trick. To prove it a strip had been left untreated. On the untreated land a measured area yielded one small pile of weeds and a little clover, but from the same area where lime and phosphorus had been used two big piles of pure clover resulted.

Nor was that all. On the way to the barn Mr. Brown pointed out two pure bred Guernseys the securing of which had taken a check for $350. A peep into the barn disclosed a worthy sire for the head of the herd and a hasty glance around the corner of the barn showed the storage plant for the corn crop. "I decided that I might just as well invest some money for the improvement of my soil and livestock as to have it laying in the bank," said Mr. Brown.

The Ford sped on. The county agent and soil specialist were satisfied. Was not the day fine? Had not Mr. Brown showed what to do and how to do it? Could not every other farmer do the same? They could, but—"We'll stop here," said the county agent, "Mr. Hart has asked me to look over his farm." Mr. Hart also was making hay, but it was not clover. It was a mixture of sorrel, poverty grass and timothy. That lime was first aid treatment, all agreed. "Come and see my potatoes," said Mr. Hart. The sickly vines, the puddled soil told the story. "Too much water," was the common verdict. "I need some tile and I should buy some lime," said Mr. Hart, "but I don't see how I can do it this year. I have a payment to make on the farm, I need a silo and I want to buy a pure bred bull, also —it would help greatly to lighten the work of Mrs. Hart if water could be conducted into the house."

Here was a new problem. The county agent and soil specialist knew that Mr. Hart had spoken truthfully. There are many Mr. Harts in Ohio. They are to be found in every county. Limited in capital, soil improvement often times is slow to them. There also are many Mr. Browns in Ohio. Silos, pure bred sires, home conveniences, lime and tile are possible for them. Between these two there is every gradation. The extension worker in soils must deal with this fact.

The soils of Ohio exist in a thousand and one different conditions as regards fertility. There is as much variation in this respect as there is in the ability of the men who work these soils to pay for needed improvements. For the good of Ohio these soils must be taken in the conditions in which they now exist and brought up in fertility to the point where they should be. The doing

of this eventually rests with the farmers of the state but to help in the accomplishment of this big task the Agricultural Experiment Station and College are prepared to furnish certain kinds of service.

The function of experiment stations is investigation. In its study of soil problems the Ohio Agricultural Station works with several hundred plots, each one of which is designed to tell some part of the story of soil fertility and crop production. Dean Alfred Vivian of the College of Agriculture who has circled the globe studying agricultural conditions and in his quest has visited every important experiment station in the world, states that the work in soils at the Ohio Station is more complete than it is at any other. The farmers of Ohio appreciate the work of their own station. The fact that several thousand people visited the station on the occasion of the 1917 Wheat Field Day demonstrated that they have confidence in the work of Director C. E. Thorne and Agronomist C. G. Williams.

Agricultural colleges have for their function the teaching of the theory of agriculture and its relation to farm practice. Their establishment for this purpose was authorized by the Morrill Bill which was passed by Congress in 1862 and signed by President Lincoln. Provision also has been made for the teaching staff to engage in research work. Prof. Firman E. Bear, of the department of soils of the college is a member of the staff of the experiment station and thus is able to take an active part in the research work of solving the soil problems of the state.

Extension Specialist Securing a Sample of Soil for Analysis

Extension service in soils in Ohio is one phase of the work of the department of soils of the college of agriculture. Thru it the campus activity in teaching is extended to include the whole state. Extension specialists in soils are regular members of the department of soils and are responsible

to the department for subject matter and the division of their time. As a rule they have no connection with class room work but devote their entire time to work in the field.

The purpose of extension service in soils is to promote a wider adoption of the practices that have been proven good by the research investigations of agricultural experiment stations. This is done thru lectures, demonstrations and any other methods which may be adapted to the purpose. In common with other forms of extension service funds are made available for this work thru state and federal appropriations.

At the present time two men are engaged to give their entire time to service in the field. A third man is employed half time as chemist and does such chemical work as service in the field makes desirable.

As organized at present extension service in soils is separated into six main projects. They are: (1) extension schools, (2) county agent service, (3) correspondence courses, (4) correspondence, (5) publications and (6) field meetings in counties where no county agent is employed.

From forty to fifty extension schools are held each year. From November to March the extension specialists in soils serve as instructors in these schools and give definite courses in soil fertiilty and crop production. These include as much of the regular college courses as can be adapted to the audiences of farmers and presented in ten lectures of one hour each. During the past season 1,205 men attended these schools. In connection with the work in soils and crops one other course such as animal husbandry, dairying or horticulture is given at each school by a member of the department represented.

Service to county agents is the most recent phase of extension work in soils. In these counties which are organized the county agent is the representative of the college of agriculture. All work is undertaken thru him and with his consent. Under present arrangements the state is divided into three groups of counties and the soils work in any one group is under the supervision of the extension specialist in soils who is alloted to that group. This specialist is responsible for the work in soils that is done in those counties. It is his duty to aid the county agent in planning the work to be conducted in the county and to aid in its promotion in any way that may be mutually agreeable.

The soils problem needs to be attacked in a systematic manner. Experiments have shown the advisability of certain practices in the maintenance of soil fertility. These are quite generally known but not consistently adopted. They need more emphasis in the developing of permanent systems of soil management in Ohio. The need for system in this has led to the establishment of projects which are outlines of the work to be accomplished and methods to be pursued. With projects in mind the county agent can look forward to doing certain definite things each year. When a project is finished it enables the county agent to point to certain definite things that have been accomplished. Unless some such system is adopted the county agent is apt to find after a few years that he can point to few definite things that have been accomplished.

During the last two years in which a correspondence course in soil fertility has been offered, over 2,000 students have been enrolled. The course consists of 11 lessons and a student must finish

each lesson and report on it before the next one is sent. This means that the less interested ones never get farther than one or two lessons. However, more than 300 persons already have finished the course and a large number of others have nearly completed it.

The attitude of farmers toward improved methods of soil management is shown by the heavy correspondence received at the college. As the extension specialists are most closely in touch with soil conditions of the state much of this correspondence is passed on to their desks. Many soil samples are received with requests for advice in regard to treatment. When no sample accompanies the request, the usual plan is to write and ask that one be sent for examination. A questionaire sheet is enclosed which is to be returned with the soil sample so that the specialist may have some knowledge of the past history of the soil and the present system of farming. When the soil is received it is tested for lime requirement and its type compared with other soils the analyses of which are known. With this information it is possible to offer some definite suggestions in regard to a system of management for soil of that particular type under the farm conditions represented. In addition many samples of limestone are received and tested to determine their suitability for pulverizing by means of portable crushers. This work has no connection with the inspection of commercial limestones as that work is under the supervision of the State Board of Agriculture.

Publications issued as a part of extension service in soils include principally bulletins on subjects of soil management. These represent not merely the opinions of the author but research work of the department and experiment station. Before being issued, all bulletins are referred to Director Thorne for acknowledgement that the principles outlined are in keeping with station policies. This helps to keep extension service closely coordinated with station activities.

Another form of extension service that has been popular is farm visits and field meetings. As many as 150 of these have been held in one year. As the various counties become organized this activity is turned over to the county agents. However, two-thirds of the counties of Ohio have no county agents so the demand for this work still continues. Many of the requests for this service must be turned down because of a lack of men and money, but where five or more neighboring farmers ask for such service the department gives the help desired. During the past year 1,060 persons were reached thru meetings of this kind.

In addition to the above forms of service there are numerous requests for help in a variety of ways. These range from assistance in buying farms to promotion of financial schemes. Many of these merit attention but many others must be refused.

Extension service in soils is an interesting but serious business. It means taking a part in the formation of practices leading to permanent systems of soil management. Advice wrongly given may lead not only to the starting of wrong practices in an entire community but also to financial loss to those least able to bear it. This service is planned on the belief that to help in changing the soil fertility of a farm, community or county from the condition in which it may exist to the point where it should be is for the good of Ohio and a duty of the college of agriculture.

Home Economics Department

CONSERVATION AND COLLEGE GIRLS

DORIS McCONATHY, '17

CONSERVATION is a subject which is being discussed on every side, but many are not thinking seriously upon it. Have we thot of conservation as applying to large groups and institutions without realizing that it applies to each one? Until the people of the United States recognize an individual responsibility, we can hope for little in this campaign of conservation. Not until our view extends beyond the border of the homes, the states and the nation to the struggling peoples of Europe will we realize the problems that are confronting the United States.

To be sure there must be leaders, not only federal and state, but in every community. To whom shall we look for community leaders? In a recent talk before an audience of freshman girls Miss Edna N. White, head of the department of home economics at the Ohio State University, said, "College girls should be the ones interested in conservation."

Surely the students of a state university owe something to their state—a debt which can be paid only thru loyalty and service. College girls can help to turn the activities of their community to that field of service which is to play one of the important roles in the winning of this war—the conservation of food.

According to Miss White, the French are demanding 100,000 tons of sugar per month. The allowance is less than one ounce per day per person and we are using more than four times as much. At our present rate of consumption our supply will last until January when the new supply arrives. Can we not afford to reduce our supply in order to help the noble French who will otherwise be without this necessary food?

The shortage of wheat presents a serious problem to our allies. Not only has the productivity of the land been greatly reduced but the number of people to till the land. In many places the women are carrying that burden in addition to all the other war services. It is almost necessary that our allies have wheat since they are unaccustomed to corn meal, and its keeping qualities are not such as to warrant its shipment so great a distance.

This shortage does not stop with food but extends into the amount of wool. If college girls would look about them they would not ask how they could help in this. Surely no one would deny a girl's right to a warm sweater but does she really need more than one?

The plea for conservation is not a plea for sacrifice to the extent that one should suffer physically, as this is a time to keep physically fit. The plea is that we give up the unnecessary and avoid waste. A card is displayed in the restaurants of England asking that all bread that is not eaten be saved. Realizing that bullets of food may mean more than actual munitions, college girls should preach a new gospel—the gospel of the clean plate.

HOME ECONOMICS IN RURAL SCHOOLS

TREVA E. KAUFFMAN, Ohio State University, Columbus, Ohio

THREE years ago the department of home economics extension of Ohio State University decided to take up this work thru the county normal schools, by giving a week of instruction to the rural teachers attending there. Since home economics covers a wide field it was found impossible to take up but one phase of the work—the study of foods. There were two reasons why people objected to the introduction of home economics in the rural schools. First was the lack of space and equipment and then the lack of time. It has been demonstrated that these objections can be overcome.

The minimum cost of new equipment would be about $8. This could be secured in a variety of ways. The space required is small and a cloak room could be used. The second objection is the more serious. In the one room rural school the number of classes tends to outnumber the possible hours for recitation. But since home economics is related to all other subjects taught in school no time need be lost in introducing it according to the following plan:

How We Manage.

Twenty food lessons have been worked out which give directions for the preparation of practical dishes that can be used to supplement the cold lunches brought from home. The demonstration of a new lesson by the teacher requires 30 to 40 minutes per week. Usually we serve an extra dish every day but no school time should be used for this except on the day of the lesson. On the other days the extra lunch dish is prepared before school or at the noon recess.

A committee composed of three or four of the children is appointed each week. Their duties are to see that supplies are ready for the lesson, to help in serving and clearing up the lunch. The necessary supplies are brought by the children from their homes. When divided among 20 or 30 pupils this is not a burden upon any one family.

In order to encourage the further practice of food preparation and to bring the interests of home and school nearer together, a card record of various home duties performed by the pupils is kept by the teacher. It is desirable that all dishes made at school be repeated at home several times. To stimulate interest in this, the teacher should keep a record of each pupil's trials, noting the successes of failures, and judge those brought to the school.

Centralized School Lunches.

The school lunch is more of a problem in the centralized schools than in the one room schools. Many of the children ride long distances in the early morning, often without breakfast, and remain in school all day with nothing but a cold lunch at noon. They return late in the evening, eat a heavy meal and go to bed. A warm breakfast should be eaten, a warm lunch at noon, and a light supper at night.

Children that are not properly nourished can not study well. Serving hot lunches is not only a means of introducing home economics into the schools but the children thrive better and do better school work. If the older girls can prepare food, serve it, calculate the cost and keep accounts, a valuable lesson in home economics has been taught. About 20 centralized schools in Ohio were serving hot lunches at the close of the year 1915-1916. If the

supplies are brought from the homes the whole school is served free but if they are purchased a charge covering the cost is made.

In the Wadsworth centralized school in Medina County, domestic science and manual training were made possible by installing a lunch room which was paid for by entertainments. If a visitor should happen into this school during the noon hour, he would see the teacher and pupils pass thru the lunch room, helping themselves, and paying with a ticket. The visitor would also have his choice of the following: Cocoa, potato soup or cake. The pupils bring a few sandwiches to supplement the food offered. The seventh and eight grade girls prepare this food, calculate the cost and keep accounts.

The lunch room at the Hilliards centralized high school has been successful for three years. Each week a committee of three senior girls plan and prepare the lunches. The treasurer, who is also a senior, pays all bills and takes care of the money. Altho the aim has been to merely cover the cost of the food, there has been enough profit to pay for some new equipment. A typical lunch served at this school consisted of vegetable soup, cocoa, sponge cake, ham sandwiches and stewed apricots.

In one public school in Fayette County a number of the children were in poor physical condition and delinquent in their studies. The superintendent started to serving breakfast and the children greatly improved in health and ability to grasp their studies. Many children in good homes are underfed as a result of the ignorance of parents or of a lack of discipline which permits the child to refuse to eat the proper kinds and amounts of food. When fed at school the child is likely to eat what is offered him due to the psychological influence of others eating.

PLOT EXPERIMENTS ON THE UNIVERSITY FARM

MELBY W. BRADY, '17

IN 1882 the Ohio Agricultural Experiment Station was established in accordance with an act of the General Assembly "for the benefit of the interests of practical and scientific agriculture, and for the development of the vast agricultural resource of the state." The late Professor Wm. R. Lazenby was the first Director and had charge of the experimental work for the greater part of the time the Station was located at Columbus. In 1892 the station was moved to Wooster, Ohio and for a number of years the work at Columbus was conducted in co-operation with and under the supervision of Director Thorne of the Station, Professor Lazenby acting as Vice-Director. The experimental work which was carried on at The Ohio State University during this period was on land located west of the campus woods and south of Woodruff Avenue being that part of the campus now occupied by the aviation barracks and the Robinson Laboratory.

Since the removal of the Ohio Agricultural Experiment Station to Wooster, such experimental work as has been carried on at The Ohio State University during recent years has been under the supervision of the department of agronomy now divided into the departments of farm crops and soils. The necessity for plot experiments available for demonstration purposes in

connection with the teachings of crops and soils has been responsible for the efforts put forth by these departments in trying to keep the experimental work going. This need has been so

Planting Wheat for Experimental Work

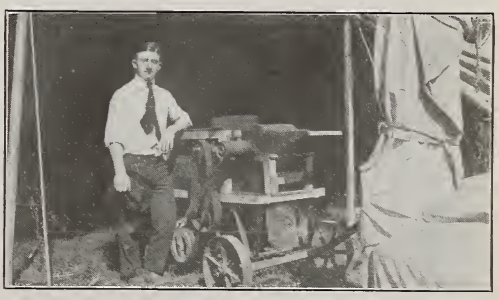
keenly felt during recent years that the trustees of the university have seen fit to set aside a tract of 80 acres to be devoted to this work. Some preliminary work is being done on land now available and will be extended as the new plots are developed.

The projects now in progress at The Ohio State University may be considered under the following heads: demonstration of established facts; research in crops and soils; crop improvement thru breeding and selection and growing plant material for laboratory use.

As an illustration under the first heading we might mention the high and low ear corn demonstration. A plot was grown in which the ears on the average were six and one-half feet from the ground. In a plot immediately adjoining the ears averaged not over two feet in height. This striking difference was brought about by several years of selection, starting with a uniform lot of seed and selecting the highest ears from the high eared plot and the lowest ears from the low eared plot for seed. The seed from which these demonstration plots were grown was obtained thru the courtesy of Dr. L. H. Smith of the Illinois Experiment Station. This experiment serves to illustrate the principle that a convenient height of ear for husking can be obtained by continuous selection of seed ears of the desired height.

Under research problems we will consider briefly the experiment planned to teach the nature of the effect of a crop upon the succeeding crop. We have reason to believe that there is ofttimes, an effect which cannot be explained from the standpoint of soil fertiilty but which seems to be due to a toxin secreted by the plant or produced by the decay of its roots. A succession of crops grown in soil in cylinders of three feet in diameter is under observation from which we hope to learn something about this phenomenon.

Breeding and selection offers a wide field for the investigator. Work along these lines at The Ohio State University is being carried on with the various farm crops, both rare and common, and some very interesting and practical results are being obtained. The method of experimentation varies but little with the self-pollinated cereals; either pure



Machine Used for Threshing Grain From the Plots

line selections being made from the mixed population and propagated in rows or hybrids are made between pure lines and pedigree selections made from the progeny. With the cross-pollinated

species, self-pollination is first accomplished and pure lines are developed if possible. A capsule devised by A. E. Waller and L. E. Thatcher of the department of farm crops and described in the April, 1917 number of the Journal of The American Society of Agronomy is being used successfully to inclose the inflorescence of plants for self-pollination. In the work of hybridization some interesting species of hybrids have been obtained with the cereals.

The improvement of the soy bean has received considerable attention during the past year in order to obtain a strain better suited for use as human food. The percentage of protein and oil contained in the soy bean can be changed almost at will by selection.

All isolated strains are tested for yielding capacity, being grown the first year in plant-rows each 4 feet long and containing 24 grains spaced 2 inches apart in the row. The second year seed from these is sown in rod rows ,each sort being replicated three times and alternated with a common "check row" which served the double purpose of reducing the effect of competition between strains and affording a knowledge of the fluctuation in the productivity of the soil. From these rod rows only the best yielders or otherwise desirable strains are propagated the third year, the plots being one-fortieth acre in size and replicated three or four times.

During the past year the number of varieties and strains tested at The Ohio State University is as follows: Wheat, 350; Oats, 125; Barley, 600; Rye, 40; Soybeans, 28. In addition to these a large number of rare and special crops from various parts of the world were under observation.

Of the 350 strains of wheat tested, 40 give promise of being adapted to conditions as found in this part of the state. It is hoped to reduce this number by further selection to a few extremely desirable ones. The work with oats is very promisiing. Some interesting hybrids have been produced by crossing the wild Avena fatua and the common Avena nuda. Another very interesting cross is that between a bearded, two-rowed, black, hulled barley and a hooded, six-rowed, white, hulless barley. As a result some desirable material for genetic studies has been collected and some strains of practical value isolated.

However, the most interesting experiments have been those with soybeans. The wide range of variation in adaptability to soil and climate, yield of hay and grain, disease resistance and palatability, has afforded excellent material for the skill of the plant breeder. A cross has been made between a dwarf glabrous soybean and a tall pubescent one from which it is hoped to segregate a strain for hay, free from the irritating dust produced by the fine hairs of stems and leaves.

A large amount of plant material has been grown and harvested for use in the farm crops laboratory, the object being to acquaint the student with the characters of the various farm crops thru actual contact with the crop itself.

GROWTH OF AGRICULTURAL EXPERIMENTS IN OHIO.

(Concluded from page 142)

one man in each state in the Union, unless something deeper and broader could be seen in this training than the making of a livelihood. But the candidates for degrees in arts and engineering were preparing themselves for earning their living as teachers, lawyers or engineers. They were expecting to occupy high places in the social structure of the state.

Early Development of Station.

Under such circumstances the experiment station began the extension of its work on the university farm. The field now occupied by the engineering buildings was thoroly underdrained, and a series of experiments were begun in the use of chemical fertilizers, the chief stress being laid upon the growing of corn, oats and wheat continuously on the same land, following the Rothamsted example, but cultural experiments were continued in the bottom fields.

But the encroachment of the city made itself felt sooner than President Hayes had predicted. An intercepting sewer was dug from north to south thruout the entire length of the best part of the bottom land, going to the depth of 12 feet in places, bringing up the gravel and spreading it over the surface for rods in width. Another sewer was dug across the farm from east to west; the streets north and south of the farm were paved; a strenuous pressure was brought upon the University to open Neil Avenue thru the farm, and the leasing of building lots along its several frontages was seriously considered.

Under such circumstances it soon became evident that no work in soil study could be undertaken on this farm with the purpose of determining the causes any prospect of permanency. But the little work that had been done, crude and imperfect though it was, had convinced the management of the Station, as much by its failures as by its successes, that knowledge can never reach scientific accuracy until the hypotheses suggested in the laboratory are confirmed or rejected by the field itself.

This was not a popular doctrine at that time. The prevailing conception of scientific research in agriculture had been imported from German laboratories. The apparently contradictory results which are the rule in the earlier stages of a field experiment had been accepted as proving the impossibility of attaining scientific results in the field.

To the management of the Ohio Station the quiet, English tenacity which had been hammering at one little problem in Broadbalk Field for thirty-odd years at that time — more than 60 years now—made an irresistible appeal, an appeal strengthened by the first few years' results on the little tract of land north of the Administration building.

Relocation of the Station.

It was the conviction that the deductions of the laboratory must be carried to the field for final confirmation; that this confirmation must be wrought out by methods as thoroly scientific as any practiced in the laboratory; that the work must be carried through cycles of ever changing seasons, and that there was no adequate amount of suitable land on the university farm for this work and no prospect of being able to retain control of any land there for a sufficient length of time to secure trustworthy results, that led to the removal of the station to Wayne County.

Moreover, the orchards of Ohio were steadily failing in fruitfulness. Work

was attempted in leased orchards for of this failure, but it was soon found that in this work permanency of tenure was as important as in field experiment, and neither suitable orchard land nor permanency of tenure was possible on the university farm.

In September, 1892, the Station was transferred to Wooster, Wayne County, a home of which it was sole proprietor, and not merely a tenant-at-will, and which had been selected in the light of the 15 years of previous experience in field experimentation. Work was immediately begun in the preparation of the land for its use by thoro drainage of the part selected for field experiment and by the planting of an orchard.

Before any thot of moving the station had been entertained it had been realized that no single farm could furnish soil conditions that would be a sufficient guide to the treatment of all the soils of the state, and attempts had been made at instituting cooperative experiments with farmers in different sections. It was not difficultt to find farmers who were glad to undertake such experiments in a small way, but it was soon found that most of the soils of Ohio require drainage before consistent results in field experiment can be hoped for, and that the successful outcome of such experiments depends upon a longer continuance in the work and a closer attention to minor details than any farmer can afford.

Expansion of Work.

For these reasons, one of the first acts of the station, after its removal to its new location, was to lease a tract of different character, the lease being taken for 10 years with option of purchase, and to start upon it a series of experiments duplicating those inaugurated at the home station.

During the next 10 years the Station was finding itself. There was litigation without, there was self-seeking within. Following the example set in many other states the work of orchard and nursery inspection and of livestock inspection was laid upon it for execution, to the detriment of its true work of scientific research, and at the end of this period a second reorganization took place.

During this period the field experiments were demonstrating the usefulness of this form of research; plant diseases and insect pests of the orchard were being brought under control; the possibility of immunity from bovine tuberculosis was being demonstrated, and in various minor ways the foundations were being laid for a statewide expansion of the Station's work under a clearer conception of its functions.

Expansion of Present Station.

With the reorganization of 1902 the Ohio Experiment Station entered upon the third stage of its work, being now free to devote its energies solely to the conduct of scientific research in agriculture and the practical application of the results of such research to the work of the farm. Two additional test farms were leased that year, one in Montgomery County and one in Meigs County, for the purpose of studying the soil and climatic conditions of southwestern and southeastern Ohio. In 1909 a small farm was leased in Hancock County and in 1910 an Act was passed by the legislature authorizing the establishment of a county experiment farm, by any county in the state, to be operated by the Station. Under this act such farms have been established in Paulding, Miami, Hamilton, Clermont, Washington, Trumbull, Mahoning, Belmont and Madison counties. Under a law passed in

1915 two forest tracts were purchased by the Station, one of 1,500 acres in Lawrence county and one of 220 acres in Athens county.

The leased farms have been purchased, so that the Station has risen from the position of a tenant-at-will to the ownership of more than 2,600 acres of land, in addition to nearly 1,400 acres operated under perpetual lease in the 9 county experiment farms. The buildings on the home farm contain laboratories equipped for the most elaborate research in the chemistry and biology of plant and animal nutrition.

What the Station Has Done.

One of the valuable works of the Ohio Experiment Station has been the placing of field experiment on an equality with laboratory investigation as an indispensable instrument of scientific research in agriculture. The accomplishment of this result was made possible thru the good fortune of the station in being permitted to select a field experiment and thru the faithfulness of the men charged with the execution of the work.

As a result of this work, supplemented as it has been by a state-wide survey of the soils of the state, the station is now able to lay methods before the farmers and fruit growers of Ohio by which the yields of fields and orchards may be immediately increased and maintained profitably by measures within their reach.

These methods have been deduced not from results obtained on a single farm but from experiments conducted on several of the leading soil types of the state which have been in progress for 13 to 24 years.

Because of this work it is now possible for the Ohio farmer to forecast the outcome of the treatment of his land with manure, lime and chemical fertilizers with a greater degree of accuracy than has heretofore been possible to any farmer in any part of the world.

This work has been supplemented by improvement in the quality of the cereal grains thru selection; by increase in yield of grains and fruits thru cultural methods; by better control of injurious insects and fungous diseases of plants; by increase of our knowledge respecting the function of elementary substance in food; by demonstration of methods by which the livestock of the farm may be more economically fed and kept free from disease, and by the accumulation of data respecting the influence of heredity in milk production.

Inspection Work.

The appearance of the San Jose scale in the United States introduced a new factor in our orchard industry. The Ohio Station began the study of measures for the control of this pest immediately upon its appearance in the state, and when the law was enacted providing measures for its control the administration of the law was lodged with the Experiment Station.

Soon after this the work of the State Live Stock Commission, having for its object the control of contagious diseases of animals, was also transferred to the Station. But the enforcement of these measures was found to interfere with the work of scientific research, and at the Station's request this work was transferred to the State Board of Agriculture, which was already engaged in the similar work of fertilizer inspection, thus bringing all work of this character under one executive head.

Extension Work.

A few years ago a request came to the Experiment Station to conduct a one-week school of agriculture in Paulding

county but this request was referred to the College of Agriculture as being educational work and therefore more appropriate to that college than to the Experiment Station. From this beginning grew the system of extension schools which the college has since conducted.

For many years there has been increasing evidence of the need of some more efficient means of getting the results of the work of the Experiment Station before the farmers of the state than its bulletins and the small amount of work which it is possible for members of its staff to do at farmers' institutes. After several years of preliminary work a cooperative arrangement was made in 1911 between the Experiment Station and the Bureau of Plant Industry, United States Department of Agriculture, under which the station undertook to locate a county agricultural agent in any county that would join in the expense of maintaining such an agent. Under this arrangement county agents had been located by the station in 8 counties when, in the spring of 1914, the National Congress passed the Smith-Lever Act, providing for the support of work of this character thru the agricultural colleges of the different states, and therefore this work was transferred to the College of Agriculture in February, 1915.

While this work seemed entirely appropriate to the Experiment Station, which had organized and fostered it, yet it is also appropriate to the college and the transfer was made willingly by the station.

The fact to which this record of the shedding off of superabundant opportunity leads is that the Ohio Experiment Station has been permitted to restrict its energies to the work of scientific research in agriculture and that the support of this work has justified the course it has taken. The appropriations by the state for the support of the station have increased from zero for the year 1887, when it was expected that the Hatch Fund would be a sufficient support, to more than $300,000 for the current year. Meanwhile, the attendance at the Ohio College of Agriculture has risen from the total of 32 enumerated for 1887 to 1,198 for the year 1916-17.

The Experiment Station and the Agricultural Student.

There are few areas of the earth's surface of equal extent to that of Ohio in which the problems relating to agriculture are more widely diversified. Notwithstanding the sameness of topography over a large part of the state, there is a wide variation in soil, climatic and industrial conditions and the student whose opportunity for observation is limited to any single farm or any single county in the state will fall far short of attaining an adequate conception of its agriculture.

A card published by the College of Agriculture very appropriately states that "The Campus of the Ohio State University is the whole State of Ohio;" and it is equally true that "The Laboratory of the Ohio Agricultural Experiment Station is the whole State of Ohio," for the experiment fields scattered over the state are its real laboratories and to comprehend its work these fields must be studied.

An official brought in from another state, who had never seen any of the Station's work and, so far as is known, had never had an hour's conference with any member of its staff, writing a few years ago in that superior wisdom which some possess by intuition, said:

"The modern idea of teaching successfully contemplates the laboratory method. In most of the states the great laboratory—the Experiment Station—is closely allied, and run in connection with the agricultural department of the State University thereby giving to the student of agriculture in the university the advantage of the agricultural experiments conducted at the Experiment Station. Under the present system in Ohio in order to conduct a high grade agricultural college it is necessary to carry on work at the university similar to that being done at Wooster. This involves a large waste and a needless duplication. The work should be transferred ultimately to Columbus in order to obtain maximum returns for the money and effort expended along this line. In view of these facts I am recommending that no further additions and betterments be made at Wooster and I recommend strongly that the General Assembly consider the advisability of transferring the work now being done at the Experiment Station and consolidate it with the agircultural college work."

It would indeed be very convenient if "the great laboratory, the Experiment Station," could be displayed on the University campus; but by the time its more than 3,000 plots, mostly one-tenth acre in size, with their attached soils and subsoils—the silty Wooster loam; the Volusia types of the Cuyahoga, Mahoning and Trumbull county farms; the partially reformed black swamp of Paulding county; the different types of Miami soils of the Miami, Montgomery, Madison and Hamilton county farms; the impoverished Clermont soil; the rolling hills of Meigs, Washington and Belmont counties were spread over that campus, I fear there would be no room left for students, especially as these plots comprise only a part of this great laboratory, for on all these farms the land not under plot work is occupied by field work which is of importance only second to that of the plots.

Fortunately the legislature had a finance committee and the state had a governor whose horizons were wide, and the reply to this recommendation was an increase in the appropriations for the station's work.

The mountain cannot come to Mahomet, but Mahomet can come to the mountain, and the student who wishes to study the work of the Ohio Agricultural Experiment Station will receive a most cordial welcome and every assistance that the Station staff can give him.

ANNUAL TRIP TO WASHINGTON.

President Wilson, Herbert Hoover, Senators Pomerene and Harding and others will address the 500 corn prize winners on the sixth annual corn boys' tour to Washington and New York which starts December 3.

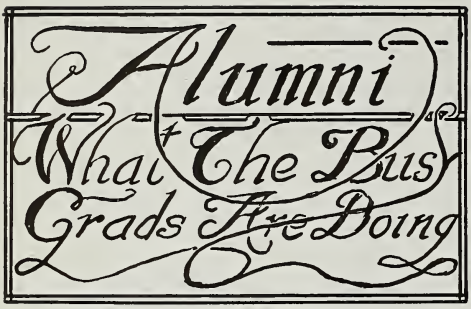
Reservations are being made for another 500 who may wish to accompany the winners on this sight seeing trip thru the East. The estimated cost for the additional 500 is $60 each.

The winners will visit Washington, Mt. Vernon and New York with cruises on the Potomac, the Hudson and New York Harbor. On Friday evening, December 7, all will leave New York for their homes in the Buckeye state.

SADDLE AND SIRLOIN CLUB.

Beginning its twelfth year as the official organization of the department of animal husbandry, the Saddle and Sirloin Club elected the following officers: Ralph Richardson, president; Charles Sprague, vice-president; Don Drake, secretary; Guy Jump, treasurer.

HAVE YOU RENEWED YOUR SUBSCRIPTION TO THE AGRICULTURAL STUDENT YET?



A G. McCall, '00, who was formerly professor of agronomy at Ohio State University, is now located at College Park, Maryland, where he is connected with the Maryland Experiment Station. He is also doing lecture work in the Johns Hopkins University.

Leland E. Call, '06, is professor of soils in the Kansas Agricultural College at Manhattan, Kansas.

Earl C. Sleeth, M. A., '17, is county agent in Cuyahoga County, Ohio.

Robert M. Salter, '13, is professor of soils in the college of agriculture at Morgantown, West Virginia.

John Bard, '15, is farming near Gerard, Ohio.

Ira Beerbower, '15, is on a farm near Hicksville, Ohio.

Glen A. Boger, '15, is with the John Wildi Evaporating Milk Company at Lewisburg, Pennsylvania.

Reginald C. Collison, '08, is an assistant in soil investigations at the New York Agricultural Experiment Station at Geneva, New York.

Burns L. Childs, '15, is engaged in general and tobacco farming near West Middletown, Ohio.

Clarence A. Dawson, '15, is doing missionary work in connection with the teaching of agriculture in the Christian College at Allahabad, India.

Stanley E. Collison, '08, is a soil chemist in the Florida Agricultural Experiment Station at Gainesville, Florida.

Carl W. Farison, '15, is farming near Napoleon, Ohio.

Aaron F. Head, '16, who was formerly with the department of soils in the Michigan Agricultural College is now stationed at Sackett's Harbor, Madison Barracks, New York.

H. Wayne Palmer, '16, formerly a graduate assistant in the department of agricultural chemistry, is now teaching science in the high school at Middlebourne, West Virginia.

Lawrence Buckley, '17, was married to Miss Marie Kintner of Columbus and they will reside in West Park near Cleveland where Mr. Buckley is engaged as a horticulturist.

Robert Fleming, '15, is teaching agriculture in a high school at Youngstown, Ohio.

Oliver Gossard, '15, is an assistant in the department of soils at the Ohio Agricultural Experiment Station at Wooster.

Ernest R. Hoftyzer, '15, formerly with The Cleveland Press is now at Fort Benjamin Harrison in the training camp.

Hulda Horst, '15, and Charlotte Johnson, '15, are both instructors in home economics in the extension department of the Ohio State University.

Clifford H. Moss, '15, is farming near Westerville, Ohio.

Walter A. Alexander, '16, is teaching agriculture in the Western Reserve Academy at Hudson, Ohio.

Douglas E. Pickens, '15, is farming near Ripley, Ohio.

Glenn G. Roberts, '15, is engaged in farming at Findlay, Ohio.

Leo L. Rummell, '15, is in charge of the editorial work at the Ohio Agricultural Experiment Station. Mr. Rummel was editor of The Agricultural Student during his senior year in school.

NOVEMBER NEWS FOR SCHOOL AND FARM

JUDGING CONTESTS.

Missouri's team composed of M. R. Dunn, Otto Schaefer and D. V. Atkeson won the sweepstakes at the annual students' judging contest held at the National Dairy Show, Columbus, October 18 to 27. Iowa State College placed second, Nebraska University third. Ohio State University ranked twelfth.

M. R. Dunn won the De Laval scholarship of $400 and was high man in the contest. C. A. Marsh of the Iowa State College was second high man and Otto Schaefer of the Missouri team third.

The University of Nebraska was awarded the Holstein-Friesian cup being the highest team in the judging of that breed. J. R. Shepherd of Nebraska received the Holstein scholarship.

The Jersey cup was awarded to Missouri; they also won the Iowa Dairy Separator scholarship and loving cups from the National Dairy Association. The Iowa State College took the loving cup offered by the J. B. Ford Company for having the second highest team in the contest.

The South Dakota State College team won the J. G. Cherry Company cup for the highest team in judging butter and the J. B. Ford Company cup for judging market milk at the National Dairy Show. The Hoard's Dairyman cup for cheese judging went to the University of Nebraska.

The men receiving gold medals from the National Dairy Show Association on judging of all dairy products were: A. Miller and A. Tompkins of the South Dakota State College, Eli Duncombe and J. R. Shepherd of the University of Nebraska and D. S. Kocheiser of the Ohio State University.

South Dakota stood first on all products, University of Nebraska was sec-

Stock-Judging Team From Ohio State

Reading from right to left: Ralph Richardson, Fleming Burbank, Ralph Neher and Coach Schuyler M. Salisbury

ond and Ohio State University was third. D. S. Kocheiser, a junior in the college of agriculture, was the highest man in the judging of market milk.

SEVENTH ANNUAL APPLE SHOW.

Under the auspices of the Horticultural Society, the seventh annual apple show will be held in the Horticultural and Forestry building on December 13, 14 and 15. The show has grown in size and importance until it is regarded as one of the best in the state. All of the responsibility and management of the affair rests upon the members of the Society which is represented by the Apple Show Committee.

The name is retained chiefly because of precedent but in addition to the apples, there are exhibits of flowers, landscape work, and vegetables. Many novel and entertaining as well as practical and educational displays are offered for the benefit of the visitors.

Students are preparing a collection of citrus and other tropical fruits which will be shipped from Florida and Cuba in time for the show. An apple pie-baking contest will be held for the home economics students. The greenhouses will be open to visitors and an attendant will be in charge to answer questions. Cider and home made candy will be on sale at all times. Bees will form an interesting part of an exhibit which is being planned for the instruction of all.

Many wonder how such a large undertaking is financed when no admission is charged. Cash donations are solicited from the students in horticulture, goods are donated for premiums by those in the horticultural business and advertising space is sold in the premium list, but the main source of revenue is the products which are exhibited.

These become the property of the Society and are sold at auction on the evening of the last day. Part of the cash and the whole of the donated articles such as spray materials, nozzles, fertilizers and ladders are used as premiums.

There are two general divisions in the list of prizes: students are placed in one group and commercial exhibitors in another. This helps to enliven the competition and distributes the premiums.

H. J. Ruetenik is chairman of the committee and all communications should be addressed to him in care of the Department of Horticulture at the Ohio State University.

PROFESSOR RESIGNS.

Professor Vernon H. Davis of the department of horticulture who was business manager of the Agricultural Student for four years, has resigned from the instructional force of the University. Mr. Davis has been named director of the new state bureau of markets which was created by the last legislative session. His duties will consist in bringing about a closer cooperation between producers and consumers.

TOWNSHEND ELECTS OFFICERS.

Townshend Agricultural Society elected the following officers for the present semester: Melby W. Brady, president; R. C. Fisher, vice-president; Wallace L. Hammond, secretary; George F. Johnson, treasurer; Carl R. Arnold, censor; Volney G. Applegate, critic; Sanford G. Price, sergeant-at-arms. Reed L. Kennedy, Marion V. Bailey and Lester N. Geiger, form the executive committee.

John E. Hull, '17, received a commission as second lieutenant in the regular army, in the cavalry division.

BARRACKS CONSTRUCTION.

Work on the barracks group of frame buildings is progressing rapidly. The group which is located east of Robinson Laboratory will be made up of two 350-foot sleeping quarters, a headquarters building and a school building. They will be one story high and will form a hollow rectangle. The machine gun range is being built west of the shops building. These buildings will accommodate 400 men and 6 machine guns.

SOME ILLINOIS RESULTS.

Roy C. Bishop, county adviser of Livingston County has published some results that were secured on 110 farms in that county by the use of different fertilizers under various systems of soil management.

Untreated land yielded 29.3 bushels of corn per acre; when manured the yield was 33 bushels; this rose to 36.4 with the use of phosphate and 40.9 with clover as a fertilizer. Oats responded just as well and showed a gain of 28.9 per cent where the land was clovered and treated with phosphate. These figures can be applied to Ohio soils also as is shown in other places in this issue.

NEW EXTENSION MAN.

A. E. Anderson, graduate of the University of Nebraska in 1912, is the latest addition to the extension department. Upon his graduation he went to the farm but later became a county agent in Wayne County, Nebraska. In 1914 he received the A. B. degree from the University of Nebraska. He was first an assistant and later county agent leader until he came here in August. Mr. Anderson has visited Europe and his former experience should make him a valuable man as an assistant county agent leader.

MOTION PICTURES.

H. M. Call, '11, of the extension department has taken a motion picture film illustrating boys' and girls' club exhibits and the selection and storing of seed corn. This has already been shown in Lorain and Summit counties. These pictures can be shown in country schoolhouses and grange halls by the use of a one ton truck which generates the lights and also turns the films. Instruction is also given in the wiring and lighting of farm buildings.

HOME ECONOMICS JOURNALISM

Because of an increasing demand for articles in farm papers and magazines upon the subject of home economics, the department of journalism is offering a new course in that subject this year. This course is being taught by Clarence M. Baker, instructor in agricultural journalism. The course is not original at Ohio State as many western colleges already have a similar course.

LATEST BULLETINS.

The following is the latest list of Farmers' Bulletins which are published by the United States Department of Agriculture:

No. 834, Hog Cholera: prevention and treatment; 842, Modern Methods of Protection Against Lightning; 845, The Gipsy Moth and the Brown-tail Moth and Their Control; 850, How to Make Cottage Cheese on the Farm; 851, The House Fly; 861, Removal of Stains from Clothing and Other Textiles; 874, Swine Management; 886, Harvesting Soy Bean Seed; and 900 on Homemade Fruit Butters.

Philip J. Kimball, '16, received a commission as first lieutenant in the field artillery.

John M. Snow, '15, is farming near Boston, Ohio.

Henry L. Wenner, '15, is farming at Carey, Ohio.

Virgil L. Overholt, '15, who has been employed as an agricultural engineering specialist in the extension department, has been drafted into the army which is in camp at Chillicothe.

W. G. Smith, '14, who has been farming near Spiceland, Indiana, has been drafted into the service.

Walter D. Will, '16, who taught in a high school at New Lexington, Ohio, last year is now assistant director of the Young Men's Christian Association in Columbus.

Robert R. Barker, '16, who has been an assistant in the department of chemistry at the Ohio Agricultural Experiment Station, has been transferred to the department of farm management to take the place of H. L. Andrew.

W. S. Barden, ex-'18, has been drafted into the army and is now stationed at Chillicothe.

Fred H. Hook, '17, is chief chemist for the Chillicothe Bottling Works at Chillicothe.

Floyd W. Duffee, '15, is teaching agricultural engineering in the Connecticut State College at Storrs, Conn.

James F. Walker, '14, is managing a farm and teaching agriculture at the Westtown Boarding School at Westtown, Pennsylvania.

Arthur C. Brookley, '12, is teaching agriculture in the high school at Harvey, Illinois. He intends to give a three months' winter course for farmers this year. This will include courses in gardening, shopwork, farm accounting and general agriculture. He writes that he expects an enrollment of at least fifty farmers from the surrounding township.

FRESHMEN WITHOUT UNIFORMS

Because of an uncertainty in the plans of the government and also a lack of uniforms for the draft army the freshmen are drilling without uniforms. This is a peculiar sight to those who have always watched the first-year men drill in uniforms, especially when they are compared with the aviators in khaki. No statements have been made as to how long this may continue.

A MISTAKE.

The article which was published in the October issue and credited to Wendell P. Miller was not written by him but by Mr. George L. Brown of New Lexington, who graduated from the college of agriculture last June.

Ralph M. Mork, ex-'17, has received a commission as second lieutenant in the infantry.